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Safety Analysis for NPPs of VVER and RBMK Types

Status of Safety Analysis Reports in Slovakia

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1 Introduction

The implementation of nuclear power program in each country is connected with establishment of the regulatory body for the safe regulation of siting, construction operation and decommissioning of nuclear installation. Licensing, one of the most important regulatory surveillance activity, is based on the independent regulatory review and assessment of information on nuclear safety of every particular nuclear installation. Documents, which are required to be submitted to the regulatory body by the applicant (licensee), usually known as Safety Analysis Report (hereinafter SAR) are presented in this paper.

2 History of legal basis

The presentation of safety relevant information to the regulatory body, to support licensing application, in a form of comprehensive document (SAR) was legally established in former Czechoslovakia in 1976, when Civil Construction Act (50/1976) was issued. The general requirements to the contents of SAR were defined in related regulation (No. 83/1976) issued in the same year.

Based on the requirements of mentioned act and regulation, the applicant for the sitting, construction and operation of any nuclear facility had to submit to the regulatory body three types of SARs. The first one, the Introductory SAR, was a part of application for site approval. It included a brief description of the main design facility features and estimated the environmental impact of facility. The preliminary SAR was elaborated and reviewed before the construction permit could be issued. It described and provided analytical and experimental evidence that all requirements on nuclear safety defined by the Introductory SAR were fulfilled in the design of nuclear installation. Quality Assurance programmes (hereinafter QA) for components, manufacturing and construction of nuclear facility were also part of the preliminary SAR. The third part of SAR was the Pre-operational SAR. It provided evidence of the installation's nuclear safety, as well as description of design changes made during construction, before first fuel loading.

Detailed content and format of SAR for the individual nuclear installation was determined case by case in a form of agreement between the regulatory body and applicant. Technical document "Rules for elaboration and guideline for the content of SARs", which was approved and issued by Czechoslovak Atomic Energy Commission (hereinafter CSKAE) was used as a background document for such agreements. This document was issued in 1977. As usual content of SAR described in the above mentioned guideline was extended by some new chapters, representing a recent development in the area.

In accordance with the mentioned documents, the SARs were elaborated. Based on the review and assessment results, start of NPP commissioning was approved by CSKAE (V1 units in 1978 and 1980, V2 units in 1984 and 1985).

In 1984, a new Act on State supervision of Nuclear Installations (No. 28/1984) was issued in former Czechoslovakia. In this act the responsibilities of state supervisory body on nuclear safety were defined more precisely. The legal duty of licensee to provide information to the regulatory body to support the regulatory review and assessment was also explicitly expressed in this act. Also, safety important modifications on nuclear installations were stipulate for regulatory review and approval in this act.

In 1988, the CSKAE guideline “Standard Content of Justification of NPP Safety - Safety Analysis Report” was issued. This guideline was elaborated in accordance with the former COMECON standards.

In 1993 all existing legal bases valid in former Czechoslovakia were kept in force in Slovakia, including those nuclear regulations and decisions made by the CSKAE.

In 1993, the UJD approved the use of US NRC 1.70 “Standard Format and Content of Safety Analysis Reports” adopted on country specific conditions for the elaboration of innovated SAR for Bohunice V2 NPP units. The innovated SAR was elaborated after 10 years of NPP operation.

In 1998 a new Act on “Peaceful Use of Nuclear Energy” was issued in Slovakia. The safety documentation for each licensing steps (i.e., siting, construction, operation, decommissioning) is clearly defined. This shall be submitted to the regulatory body to support review and assessment during the licensing process. Two sub-sets of safety documentation are distinguished in this act and regulatory involvement was a basis to create them. The most important regulatory documents (Limits and Conditions, Commissioning Programmes, QA Programmes, On-site Emergency Preparedness Plan), finally approved by the regulatory body, represent one sub-set of the documents. Another sub-set of the documents is required by the regulatory body to demonstrate the design safety as well as operational safety (i.e., SAR, plan for physical protection, radwaste and spent fuel management system, decommissioning plan, in-service inspection programme, surveillance programmes, most important operating procedures). The second sub-set of documents is reviewed and assessed by regulatory body, but it is not approved.

The contents and format of safety documents are specified in regulations and guidelines.

3 Current status of SAR for NPPs

There are three NPPs operated in Slovakia - Bohunice V1 (two units of VVER-440/V230), Bohunice V2 (two units of VVER-440/V213) and Mochovce (two units of VVER-440/V213). An overview of development process of SARs for these individual NPPs is provided in Table 1.

4 Conclusion

The SARs in Slovakia are updated within the period of 10 years to reflect the actual plant design, operation and new safety requirements. All major NPP modifications have to be supplemented by new safety analyses and databases.

The SARs in Slovakia comply to current international practice with regard both scope and used methodology.

Table 1: Development of SARs for individual NPPs

		Date	Developer(s)	Contents and format
Bohunice V1 NPP				
A	Introductory SAR	1972	TEPLOENERGOPROEKT LENINGRAD	Russian Standards for TOB
B	Preliminary SAR	1978	EBO	CSKAE guideline 1977
C	Pre-operational SAR			
D	Innovation of SAR after 10 years of operation (Chapter on accident analyses)	1990	VUJE	- -
E	Safety upgrading (small reconstruction) (Chapter on accident analyses)	1993	VUJE	- -
F	Major safety upgrading (gradual reconstruction)			
	Introductory SAR	1992	VUJE, EGP Praha	CSKAE guideline 1988
	Innovated introductory SAR	1993	VUJE, WESTINGHOSE, EGP Praha	- -
	Preliminary SAR for systems	1994-1999	VUJE, SIEMENS, VUEZ Tlmace	
	Completion of new SAR (final step of plant reconstruction)	2000	VUJE, SIEMENS	adopted US NRC RG 1.70

		Date	Developer(s)	Contents and format
Bohunice V2 NPP				
A	Introductory SAR			
B	Preliminary SAR			CSKAE guideline 1977
C	Pre-operational SAR	1984-1985	VUJE	- -
D	Innovation of SAR after 10 years of operation (Chapter accident analyses)	1995-1999	VUJE, UJV Rez	adopted US NRC RG 1.70
Mochovce NPP				
A	Introductory SAR	1984		
B	Preliminary SAR			CSKAE guideline 1977
C	Pre-operational SAR	1992	Skoda Prague, EGP Prague	CSKAE guideline 1988
D	Pre-operational SAR	1998	EUCOM, Skoda Prague, EGP Prague, VUJE	adopted US NRC RG 1.70
E	Innovation of SAR (Chapter accident analyses, 4-years fuel cycle)	1999	OKB Gidropress	adopted US NRC RG 1.70